

1 We claim:

2 1. An optical micro-switch comprising:

3 a generally planar substrate;

4 a first optical input/output port;

5 a plurality of second optical input/output ports; and

6 an optical guiding assembly operatively coupling first optical

7 input/output port to at least one of said plurality of second optical

8 input/output ports along one of plural optical paths, each of said optical

9 paths being generally parallel to said generally planar substrate, the

10 optical guiding assembly configured to moveably direct an optical signal

11 between the first optical input/output port and a selected one of the

12 plurality of second optical input/output ports.

1 2. The optical switch of claim 1, wherein the optical guiding assembly

2 further includes:

3 a optical micro-element assembly including an optical

4 microelement; and

5 an actuator assembly coupled to the optical micro-element

6 assembly, the actuator assembly configured to move at least said optical

7 micro-element substantially parallel to said generally planar substrate to

8 a predetermined position so that said optical micro-element directs

9 optical signals along a selected optical path between said first optical

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10 input/output port to a selected one of said plurality of second optical
11 input/output ports.

1 3. The optical switch of claim 2, wherein the actuator assembly
2 further includes a horizontal electrostatic comb drive.

1 4. The optical switch of claim 2, wherein the optical micro-element
2 includes a lens mounted to have an intended optical path generally
3 parallel to said generally planar substrate.

1 5. The optical switch of claim 2, wherein the optical micro-element
2 includes an optical glass ball lens.

1 6. The optical switch of claim 2 wherein there are at least three
2 second optical input/output ports, said optical micro-element assembly
3 switching said optical micro-element to plural positions corresponding in
4 number to the number of said plurality of second optical input/output
5 ports.

1 7. An optical micro-switch comprising:
2 a first optical input/output port;
3 a plurality of second optical input/output ports; and

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4 an optical guiding assembly operatively coupling first optical
5 input/output port to at least one of said plurality of second optical
6 input/output ports along one of plural optical paths, said optical guiding
7 assembly including,

8 a horizontal electrostatic comb drive, and

9 an optical micro-element operably connected to said comb
10 drive,

11 said comb drive moving said optical micro-element to plural
12 positions greater than two and corresponding in number to plural
13 input/output ports, to direct an optical signal between said first
14 optical port and a selected one of said second optical input/output
15 ports.

1 8. The optical micro-switch of claim 7 wherein at least one of said
2 input and output ports has plural channels.

1 9. The optical switch of claim 7, wherein the actuator assembly
2 further includes a horizontal electrostatic comb drive.

1 10. The optical switch of claim 7, wherein the optical micro-element
2 includes an lens mounted to have an intended optical path generally
3 parallel to said generally planar substrate.

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1 11. The optical switch of claim 7, wherein the optical micro-element
2 includes an optical glass ball lens.

1 12. A method for switching an optical signal between a first optical
2 input/output port and at least one of a plurality of second optical
3 input/output ports the method comprising:

4 a) providing said first and second optical input/output ports in
5 an arrangement generally parallel to a generally planar supporting
6 substrate;

7 b) providing an micro-optical element between said first optical
8 input/output port and said plurality of second optical input/output
9 ports, an optical path generally parallel to said supporting substrate
10 being defined between said first optical input/output port and said
11 micro-optical element;

12 c) directing the optical signal between the first optical
13 input/output port and a selected one of the plurality of second
14 optical input/output ports by shifting said micro-optical element in
15 a direction transverse to said optical path.

1 13. The method of claim 12 wherein there are at least three second
2 optical input/output ports, said step c) of directing switching said optical
3 micro-element to plural positions corresponding in number to the number
4 of said plural second optical input/output ports.

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1 14. The method of claim 12, wherein the actuator assembly further
2 includes a horizontal electrostatic comb drive.

1 15. The method of claim 12, wherein the optical micro-element
2 assembly includes an etched lens.

1 16. The method of claim 12, wherein the optical micro-element
2 assembly includes an optical glass ball lens.

1 17. The method of claim 12, wherein the optical micro-element
2 assembly includes a mirror.

1 18. An optical switch comprising:
2 a generally planar substrate;
3 an actuating assembly integrated into the substrate; and
4 an optical micro-element integrated into the actuating assembly,
5 wherein the optical micro-element has an optical axis parallel to the plane
6 of said substrate, and wherein the actuating assembly is configured to
7 move the optical micro-element parallel to the plane of said substrate.

1 19. The optical switch of claim 13, further comprising:
2 an first input/output port; and

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3 a plurality of second input/output ports, wherein an optical signal
4 is directed to a selected one of the plurality of second input/output ports
5 from the first input/output port by driving an actuator to move the optical
6 micro-element within the plane of said substrate, said actuator being an
7 horizontal electrostatic comb drive.

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